

7 directions, within said pumping chamber,  
8 (d) a gearbox, adjacent to said pump casing,  
9 (e) synchronous driving gears disposed within said gearbox,  
10 (f) a pair of hollow rotor drive shafts having a hollow portion, and an outer  
11 end, each of said drive shafts being interconnected with each of said  
12 rotors for integral rotation therewith, said drive shafts being  
13 supported in said gearbox and being coupled to one another by said  
14 driving gears, each of said driving gears being mounted on each of  
15 said drive shafts in a mutually meshing condition with said hollow  
16 rotor drive shafts being synchronously rotated in mutually opposite  
17 directions and meshing with said drive gears,  
18 (g) a pair of rotor fastening bolts, each having a bolt head at one end  
19 thereof, said bolt being inserted into a hollow portion of a hollow  
20 rotor drive shaft and being tightened for securing one of said rotors to  
21 one of said hollow rotor drive shafts with said bolt head being  
22 anchored to the outer end of said rotor drive shaft,  
23 (h) an extended drive shaft portion formed by one of said hollow rotor drive  
24 shafts extending outwardly from the gear box,  
25 (i) a cylindrical transmission coupling having an operating space, and being  
26 coupled with said extended drive shaft portion for integral rotation

27 therewith with said operating space accommodating the bolt head of  
28 the rotor fastening bolt.

1 <sup>2</sup> ~~--22.~~ The rotary pump of claim <sup>1</sup> ~~21~~, wherein said casing cover is  
2 disposed flush with said end surfaces of said rotors.--

1 <sup>3</sup> ~~--23.~~ The rotary pump of claim <sup>1</sup> ~~21~~, further comprising a recessed  
2 portion in said end surface of the rotor, a through hole in said rotor, a flange on the  
3 other end of the rotor fastening bolt, and a pair of splines on the through hole of  
4 the rotor and a spline on an inner end of said hollow rotor drive shaft forming a  
5 spline coupling for connecting said drive shaft to said rotor for integral rotation  
6 therewith, said rotor fastening bolt being inserted through said through hole of the  
7 rotor into said hollow rotor drive shaft from the side of said casing cover, said  
8 flange being engaged with said recessed portion in said rotor.--

1 <sup>5</sup> ~~--24.~~ The rotary pump of claim <sup>1</sup> ~~21~~, further comprising a through hole  
2 in said rotor, and a pair of splines on the through hole of the rotor and a spline on  
3 an inner end of said hollow rotor drive shaft forming a spline coupling for  
4 connecting said drive shaft to said rotor for integral rotation therewith, each of  
5 said rotor fastening bolts being integrally formed with said rotor, and each of said

6 rotor fastening bolts is inserted through said through hole of the rotor into the  
7 hollow rotor drive shaft from the side of said casing cover.

1 <sup>4</sup>  
--~~25~~. The rotary pump of claim <sup>3</sup>~~23~~, further comprising a fastening nut  
2 threaded onto said bolt head of the rotor fastening bolt against the outer end of  
3 said hollow rotor drive shaft.--

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1 <sup>6</sup>  
--~~26~~. The rotary pump of claim <sup>5</sup>~~24~~, further comprising a fastening nut  
2 threaded onto said bolt head of the rotor fastening bolt against the outer end of  
3 said hollow rotor drive shaft.--

1 <sup>7</sup>  
--~~27~~. The rotary pump of claim <sup>1</sup>~~21~~, wherein said rotor fastening bolt  
2 has said bolt head at one end of said rotor fastening bolt and a threaded portion at  
3 the outer end, and the rotor has an threaded hole for engagement with said  
4 threaded portion of said hollow rotor drive shaft.--

1 <sup>8</sup>  
--~~28~~. A rotary pump which comprises  
2 (a) a pump casing,  
3 (b) a casing cover for defining a pumping chamber with said pump casing,  
4 (c) a pair of rotors within said pumping chamber and having end surfaces

5 with a recess therein adjacent to said casing cover, and pumping  
6 segments engaged with each other for synchronous revolution in  
7 mutually opposing directions within said pumping chamber,  
8 (d) a gearbox, adjacent to said pump casing,  
9 (e) synchronous driving gears disposed within said gearbox,  
10 (f) a pair of hollow rotor drive shafts having a hollow portion, and an outer  
11 end, each of said drive shafts being interconnected with each of said  
12 rotors for integral rotation therewith, said drive shaft being supported  
13 in said gearbox and being coupled with one another by said driving  
14 gears, and each of the driving gears being mounted on each of said  
15 drive shafts in a mutually meshing condition with said hollow rotor  
16 drive shafts being synchronously rotated in mutually opposite  
17 directions and meshing with said driving gears,  
18 (g) a pair of rotor fastening bolts, each having a bolt head at one end  
19 thereof, said bolt being inserted into a hollow portion of a hollow  
20 rotor drive shaft and being tightened for securing one of said rotors to  
21 one of said hollow rotor drive shafts with said bolt head being  
22 anchored to the outer end of said rotor drive shaft,  
23 (h) a through hole in said rotor,  
24 (i) a flange on the other end of the rotor fastening bolt, and

25 (j) a pair of splines on the through hole of the rotor and a spline on an inner  
26 end of said hollow rotor drive shaft forming a spline coupling for  
27 connecting said drive shaft to said rotor for integral rotation  
28 therewith, said rotor fastening bolt being inserted through said  
29 through hole of the rotor into said hollow rotor drive shaft from the  
30 side of said casing cover, said flange being engaged with said  
31 recessed portion in said rotor.--

a'  
12  
1 --29. A rotary pump which comprises  
2 (a) a pump casing,  
3 (b) a casing cover for defining a pumping chamber with said pump casing,  
4 (c) a pair of rotors within said pumping chamber and having end surfaces  
5 adjacent to said casing cover, and pumping segments engaged with  
6 each other for synchronous revolution in mutually opposing  
7 directions within said pumping chamber,  
8 (d) a gearbox, adjacent to said pump casing,  
9 (e) synchronous driving gears disposed within said gearbox,  
10 (f) a pair of hollow rotor drive shafts having a hollow portion, and an outer  
11 end, each of said drive shafts being interconnected with each of said  
12 rotors for integral rotation therewith, said drive shaft being supported

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13 in said gearbox and being coupled with one another by said driving  
14 gears, and each of the driving gears being mounted on each of said  
15 drive shafts in a mutually meshing condition with said hollow rotor  
16 drive shafts being synchronously rotated in mutually opposite  
17 directions and meshing with said driving gears,

a' 18 (g) a pair of rotor fastening bolts, each having a bolt head at one end  
19 thereof, said bolt being inserted into a hollow portion of a hollow  
20 rotor drive shaft and being tightened for securing one of said rotors to  
21 one of said hollow rotor drive shafts with said bolt head being  
22 anchored to the outer end of said rotor drive shaft,

23 (h) a through hole in said rotor, and

24 (i) a pair of splines on the through hole of the rotor and a spline on an inner  
25 end of said hollow rotor drive shaft forming a spline coupling for  
26 connecting said drive shaft to said rotor for integral rotation  
27 therewith, each of said rotor fastening bolts being integrally formed  
28 with said rotor, and each of said rotor fastening bolts is inserted  
29 through said through hole of the rotor into the hollow rotor drive shaft  
30 from the side of said casing cover.

9 8  
1 --30. The rotary pump of claim 28, wherein

(a) an extended drive shaft portion is formed by one of said hollow rotor drive shafts extending outwardly from the gear box,

(b) a cylindrical transmission coupling is provided having an operating space, and being coupled with said extended drive shaft portion for rotation therewith with said operating space accommodating the bolt head of the rotor fastening bolt.

a'  
13 12  
1 --31. The rotary pump of claim 29, wherein

(a) an extended drive shaft portion is formed by one of said hollow rotor drive shafts extending outwardly from the gear box,

(b) a cylindrical transmission coupling is provided having an operating space, and being coupled with said extended drive shaft portion for

rotation therewith with said operating space accommodating the bolt head of the rotor fastening bolt.

10 8  
1 --32. The rotary pump of claim 28, wherein said casing cover is  
2 disposed flush with said end surfaces of said rotors.--

14 12  
3 --33. The rotary pump of claim 29, wherein said casing cover is  
4 disposed flush with said end surfaces of said rotors.--